

Mission Trade Space Evaluation through Multiphysics Design and Optimization

Completed Technology Project (2011 - 2015)



Project Introduction

In recent years, modeling and simulation tools have enabled engineers to design highly complex systems while taking into consideration constraints across multiple physical domains (e.g., mechanical, electronic, thermal, optical, etc.). With the current focus on improving the simulation techniques, little attention has been paid to developing CAD tools for multiphysics optimization so far. The need for powerful optimization is highlighted for instance by recent experiences with deep-space systems that have shown cost-growth issues during integration and test, and operation. These include changes in the design late in the life-cycle which often result in a ripple-effect of changes in the other areas and cause cost and schedule growth during system development. This is a key part of the Space Technology Roadmap Technical Area , Technology Area Breakdown Structure TABS 2.2.2.2. In this work our main objective is the development of new search algorithms for multiphysics design and optimization. We propose to investigate new stochastic optimization algorithms that could be used in a multiphysics design automation tool. Such an optimization tool would be able to take into account multiple objectives (such as size, power consumption, RF emissions) across multiple components and find global solutions, alleviating the costs of system engineering. With respect to space technology, this would allow system analyses to be done early enough and to be incorporated into various space-trade evaluation processes making space exploration more affordable and capable.

Anticipated Benefits

Such an optimization tool would be able to take into account multiple objectives (such as size, power consumption, RF emissions) across multiple components and find global solutions, alleviating the costs of system engineering. With respect to space technology, this would allow system analyses to be done early enough and to be incorporated into various space-trade evaluation processes making space exploration more affordable and capable.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

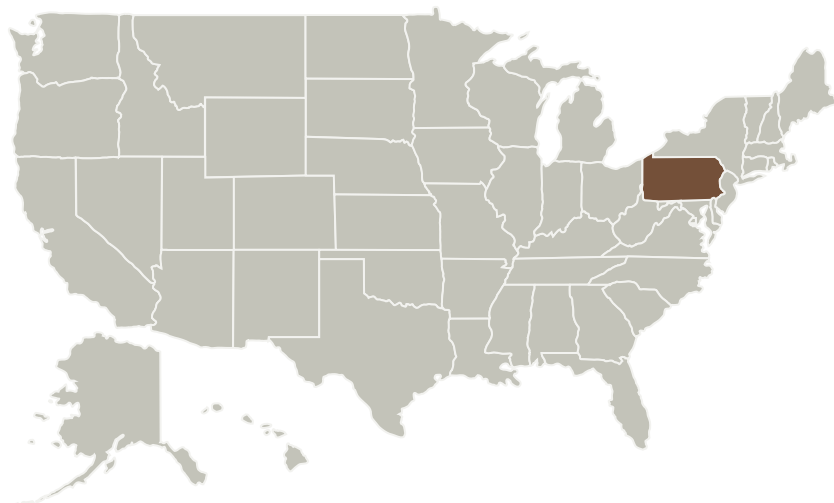
Space Technology Research Grants

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Primary U.S. Work Locations and Key Partners



Primary U.S. Work Locations

Pennsylvania

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

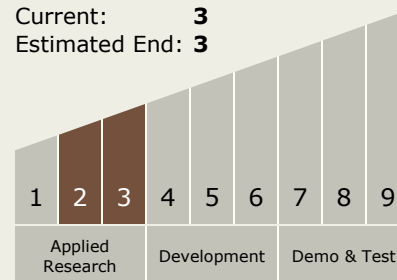
Jason D Lohn

Co-Investigator:

Irina Brinster

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.5 Mission Architecture, Systems Analysis and Concept Development

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Technology Areas (cont.)

- └ TX11.5.2 Tools and Methodologies for Performing Systems Analysis